

Inducting young children into mathematical ways of working in Hungary

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This paper outlines some initial findings from a small qualitative study exploring the ways in which teachers and kindergarten practitioners induct young children into mathematical ways of working in the last year of kindergarten and the first year of formal schooling. It presents a ‘telling case’ (Mitchell 1984) of one lesson as an example of the way in which mathematics is presented to a class in the first few weeks of formal schooling in Hungary. The mathematics involved and the ways in which the teacher works with the children are described to illustrate the centrality of mathematics in the approach and the care with which it is presented and developed with the children.

Comparative education, primary mathematics, Hungarian teaching, early mathematical learning and teaching

Background

This paper describes the findings of a small scale research project that is being carried out in a Kindergarten class (children aged 3 - 6 years) and a year 1 class (children aged 7 years) in Eastern Hungary. I made a number of visits at intervals over the course of the academic year 2010 – 2011 to look at the ways of working that the teachers adopt with young children in mathematics. The aim was to build up two cases studies over the course of the academic year and analyse the teachers' practices for comparison with established practices in England.

In undertaking this study, my research question was: how do teachers induct children into mathematical ways of working in Hungary? I chose to observe a sequence of lessons taught by one teacher in each context over the course of the academic year. Initially I observed the two classes over about a week seeing all the mathematics lessons in order to familiarize myself with both contexts and the teachers and students with my presence in the classroom. On subsequent visits I watched just one lesson in each setting.

This is in essence a small scale qualitative study and as such the question of the typicality of the observed lesson is raised. I cannot say with certainty but my experience of observing more lessons taught in other Hungarian primary schools by other teachers would suggest a strong case for typicality in some sense. My rationale for this approach is based on the case argued by Robin Alexander (2001) who suggests that presenting individual cases in comparative studies ‘side-steps this problem by claiming authenticity rather than typicality for the individual case or cases portrayed in depth’ and that ‘any one classroom can tell us a great deal about the education system and indeed the country of which it is part, but only if ... the research methods used are sufficiently searching to probe beyond the observable moves and counter-moves of pedagogy to the values and meanings which these embody’ (Alexander 2001, 266). This probing in my study was undertaken through interviews with the teachers involved about their practice, about the observed lesson and about their rationale for their practice and triangulated with additional information supplied

by my translator and interpreter. This argument suggests that lessons within single countries are more similar to each other than lessons across countries and it is within this that the case study of the presented lesson is offered.

I have chosen to engage in my research and to present it using the unit of the lesson because that is the natural unit of work for primary school teachers in which each lesson forms part of a sequence of lessons but is to a greater or lesser extent complete in and of itself. In this paper I aim to offer a holistic account of one lesson in detail as a means of capturing the broader characteristics of Hungarian primary school practice. Alexander (2001, 315) talks about the lesson as a performance of a composition in a musical sense and, as a metaphor, I find this helpful in the way in which it draws out the inherent combination of attention to form and improvisation that is at the heart of each lesson. The teachers in question would teach very similar lessons each year to the ones that I observed and each of these lessons would have some similarities in terms of form and substance with one another but also some variations.

The study

The study involved following two cohorts of children over the course of one academic year. The first cohort was from a kindergarten class which included children of mixed ages from three to six years old within which were a group of ten children aged six years old and in their final kindergarten year which is compulsory in Hungary. This class was based in an 'Ovoda' or kindergarten setting catering solely for children aged from three to six years. The second cohort was a Year 1 class of rising seven year olds in their first year of formal schooling in a university practice school taking students from seven to eighteen years old.

Data collected through classroom observation of lessons during which an interpreter was present and a DVD and audio recording made. Each lesson was followed by a teacher interview with an interpreter present and subsequently a translation was made with the help of a translator who is fully aware of the working setting and professional concerns of the teachers involved. This translator was also able to provide relevant additional background data about the Hungarian setting. During the recorded lessons detailed field notes were made and these were used to support the development of translated transcripts of the lesson. In developing my account I have privileged the voice of the teacher and my local contacts in interpreting the lesson in order to help to support the authenticity of the account. I have also focused on the mathematics in the lesson, the development of mathematical knowledge and the way in which that is shared and negotiated between the teacher and the children.

The lesson

The lesson that is presented here is one that occurred in the seventh week of the autumn term and in which the number 6 was introduced. This lesson is presented as a 'telling case' (Mitchell 1984) which captures the spirit of Hungarian primary school mathematics lessons whilst at the same time providing through the detail of the single lesson some of the essence of the way in which mathematics in worked on by teacher and students in the classroom.

The mathematical presentation in the lesson involved two parts: firstly the class focused on revision of the numbers to 5 and what they knew about them and then the new concept of the number 6 formed the latter part of the lesson. The

division of time for these two parts was one third (fifteen minutes) for the revision and two thirds (thirty minutes) for the new concept. The pedagogy used throughout this was teacher led whole class interactive teaching with frequent and enthusiastic contributions from the children which involved the majority of members of the class of thirty children.

The revision of numbers to 5 covered this topic in great depth and included aspects of the properties of numbers related to the number system that would help children develop their understanding of numbers on a firm foundation. All the activities presented in the lesson were described by the teacher as games and she frequently talked to the children using the language of playing. The revision emphasised the order of the numbers to 5 by engaging children in placing the numbers on a number line. It drew attention to the properties of the numbers in terms of their oddness and evenness and the pattern even/odd by writing the even numbers in red chalk and the odd numbers in blue chalk.

Different representations of numbers were used to broaden the children's understanding of the underlying essence of the meanings of each number, its symbol and the multiple ways in which it could be represented. These representations included hand signs, dotty patterns on 3x3 grid, the number line and dot patterns on a die. The dotty patterns on the 3x3 grid which are known as 'number-pictures' in Hungarian are a particularly powerful representation that builds on the human ability to subitise (recognise without counting) the numbers to five. Here is an example of the number 8 presented in this way:

●		●	●		
	●				
●		●	●		●

Figure 1: 'Number picture' of 8

This representation of numbers helps to support children in adding numbers in their heads without counting and then scaffolds the children's developing understanding of number bonds to twenty which are such an essential piece of mathematical knowledge.

In addition to this the class engaged in an activity involving solving inequalities. This was presented in a meaningful context related to the pictures which the teacher had uncovered on the blackboard. These pictures showed the houses in which farm animals lived and one was a rabbit hutch. The task was to find the number of rabbits who lived in the rabbit hutch from the inequality:

$$2 < \img alt="drawing of a rabbit" data-bbox="465 658 510 688"/> < 5-1$$

This involved manipulating an algebraic inequality even though it did not use letters as such. The teacher led the children through this step by step identifying with them the need to solve the expression $5-1$ first. The teacher wrote the answer to this on the board above the expression in a different colour and the children then went on to solve the inequality identifying three as the number of rabbits in the hutch. The final activity in the revision section of the lesson comprised presenting all the possible number sentences related to a picture of a sow with three piglets: $4 = 1 + 3$, $4 - 1 = 3$, $1 + 3 = 4$ and so on.

Having completed this thorough revision of the numbers to 5 the lesson progressed with the introduction of the new concept of the number 6. This was introduced through the story of the Ugly Duckling with which the children were familiar. There were five ducklings in the family and the ugly duckling formed the

sixth. The class then looked at a picture showing the ugly duckling swimming on a pond with his ‘mother’ and ‘siblings’ and the class counted the ducklings and other things in the picture. They also showed the teacher six fingers and clapped and knocked on the desk six times so they counted events as well as objects. They found six o’clock on clock faces which they all had on their desks and then found the six rod from boxes of Cuisenaire rods on their desks. All this equipment had been prepared by the teacher in the fifteen minute break prior to the lesson. These breaks occur after each lesson in Hungarian schools and give teachers ample opportunity to prepare resources including the elaborate board displays that are an important part of the presentation of mathematics in the lesson.



Figure 2: Blackboard display

The children went on to identify sets of six objects from around the classroom and then to count 6 counters from dice shaped boxes of counters they each have on their desks. These counters were then examined and the evenness of six was established by pairing up the counters. After this the ‘number picture’ of 6 was made from the counters on a ‘number picture’ blank which they each had on their desks (see Figure 1). Their counters fitted neatly into the spaces on the card. The lesson ended with the introduction of first the Roman number symbol for 6 (the symbol VI) – and then the Arabic symbol and the children made the symbol in the air with their whole arm, forearm, hand and finger in turn. The teacher showed the children some different drawings of the numeral 6 and they identified the correct one. There was not time for them to draw the symbol for themselves so that would wait until the next lesson.

Discussion

My original research question was about how teachers induct children into mathematical ways of working in Hungarian classrooms in the early stages of formal education and this account of the lesson draws attention to some key elements of pedagogy and presentation of mathematics in this context. This description of the detail of one lesson captures something of Hungarian ways of working in mathematics classrooms which has been described elsewhere in relation to secondary school classrooms (see for example Andrews 2003, 2007). The lessons are teacher dominated but have high levels of participation from the children. With younger children there is

considerable emphasis on the use of games and familiar stories with play viewed as part of the work of the lesson. As this teacher says:

I pay attention to the fact that these are very young children and I want to make these exercises interesting and enjoyable for them and so I want to connect the exercises they do with a story. This is playful learning.

The classroom atmosphere is friendly, happy and supportive and respectful for individuals but with a focus on success for all. There is heavy emphasis on the building up of common culture and routines in the classroom and connecting to the children's prior knowledge and everyday experience. As this teacher said:

They also need some connection to the senses so it is easier to teach them in this way. My goal is that each and every child can take part in the lesson and this is very important to me. ... I want to see the knowledge that the children already have: to see their knowledge, their orientation, their background. ... The children also have to be instructed in a way that helps them to cope with the practical aspects of classroom life. If I have told them to put away their books then they may ask 'can I close my book?' so they have to connect these things together. I teach them how to handle these things so that when I ask them to put away their books they also know to close them. This is not so obvious for the children and they have to be taught.

Throughout the lesson the teacher models very clearly the presentation of the mathematics that she is working on and the accuracy of the mathematical expression.

I want the children to be logical and I want to create a way of thinking in the children. It happens sometimes that a child asks something and he or she doesn't think about the conception really and he or she already knows the answer to the question and what I am trying to do is. ... I want the children to be conscious about their questions and to make good questions.

The teacher also talks about connecting everyday language to the technical language of mathematics. This careful approach is captured in her description:

It is important to teach the technical language but it is also important to connect this technical knowledge to the everyday experiences because they learn the conceptions more easily. So especially in a Hungarian language lesson it is very useful because I teach the technical name of this (cursive letter f drawn on paper) –this is a swallow and the letter f can be formed out of it. It is important to use the child's imagination because when he or she connects the letter f to a picture of the swallow, then she learns the letter more easily. It is important to handle the children at their level and to 'translate' the technical language to the language of the age group.

Concluding remarks.

Two major themes emerge from analysis of the data gathered from the lessons in general and this lesson in particular. The first is related to mathematics and the second to the social aspects of the pedagogic practices of the classroom. In relation to mathematics there is a strong emphasis on the careful introduction of the children to an established body of mathematical knowledge in ways that link with the children's development and prior understandings. This introduction is managed with a strong emphasis on mathematics and the correct use of mathematical language and mathematical expression. The pedagogic practices of the classroom are based on the affectionate and supportive relationship of the teacher with her class and the interactions of the classroom are full of respectfulness and care both in relation to the mathematics and in relation to the children. These pedagogic practices are echoed in classrooms throughout the schools for older children as well as these young children.

These observations have led me to question the foundations that underlie these practices. From interviews with the teachers involved in the research I would suggest that their confidence in both the subject area of mathematics and the pedagogy they use contribute strongly to their classroom practice. The teacher in the reported lesson graduated in 1991 and has been teaching at this University Practice Primary School since then in the Y1/Y2 class. She trained at the local university and her final practice was in this school and she became the class teacher at this school once she qualified. She is very happy at the school and does not plan to leave until she retires. She had a really good teacher leader in her school placement who helped her with her work. The secondary school, which she went to, had a strong pedagogical tradition and specialised in training kindergarten teachers. Her college course gave her lots of teaching experience. Mathematics and mathematics pedagogy was an important part of this training.

There is heavy emphasis in the classroom on inclusivity and enjoyment for all the children in the class. The teachers have a thorough understanding of child development and what they describe as 'typical mistakes'. As the teacher of this lesson said:

The reason for that is that when a child discovers his or her mistake, then when he or she points it out, then in the future he or she will possibly avoid the mistake. So this is conscious and when they see it, when they see what the most obvious mistakes are, then my experience is that the children develop and they don't make those mistakes again. In the lesson that you saw these were 'typical mistakes' – these are called 'tipikus hibák' in Hungarian. In the lesson plan these are a key points in the lesson and very important for me.

The teachers also have the security of being able to use a set of prescribed textbooks. Part of the emphasis in this initial induction period of schooling is on teaching the children to be good students in school.

This paper has sought to offer a descriptive account of one lesson as a vehicle for capturing aspects of the ways in which Hungarian teachers induct children into mathematical ways of working. Hopefully the reader is left with an impression of these ways of working that capture the central place of mathematics in the lesson as well as the careful way in which the teacher supports her students in building their mathematical knowledge. Further research comparing these ways of working with practices in England may be helpful in elucidating the significance of these descriptions for practice in an English context.

References

- Alexander, R. 2001. *Culture and Pedagogy: International comparisons in primary education*. Oxford, Blackwell.
- Andrews, P. 2007. The Curricular Importance of Mathematics: A comparison of English and Hungarian teachers' espoused beliefs. *Journal of Curriculum Studies*. London, Taylor and Francis. 39(3): 317 – 338
- Andrew, P. 2003. Opportunities to Learn in the Budapest Classroom. *International Journal of Science and Mathematics Education*. Taiwan: National Science Council. 1:201 – 225
- Mitchell, J.C. 1984. Typicality and the case study in R. F. Ellen (ed) *Ethnographic Research: A guide to general conduct*. London, Academic Press. 238 – 241